REMARKS

Reconsideration of this application, based on this amendment and these following remarks, is respectfully requested.

Claims 1 through 39 remain in this case. Claim 20 is amended.

Applicants again note the provisional double patenting rejection of the obviousness type relative to U.S. Patent No. 7,248,849 B1. Without acquiescing in the double patenting rejection, Applicants offer to provide the appropriate terminal disclaimer in this application at such time as this double patenting rejection is the sole basis of rejection.

Claims 1, 3, 10, 11, 20, 22, 29, 30, and 36 were rejected under §102(e) as anticipated by the Manickam et al. reference[1]. Claims 2, 4 through 9, 12 through 19, 21, 23 through 28, 31 through 35, 37, and 38 were rejected under §103 as unpatentable over the Manickam et al. reference in view of the Dent reference[2]. Claim 39 was rejected under §103 as unpatentable over the Manickam et al. reference and the Dent reference, and further in view of the Zangi et al. reference[3].

Applicants first respectfully traverse the §102(e) rejection of claim 1 and its dependent claims, on the grounds that the Examiner has misinterpreted the Manickam et al. reference.

The Examiner asserts that the determining of a frequency response of a conditioned channel without reference to branch-specific prefilters is taught by the reference in this passage:[4]

> Examples of the frequency response for system 200 are shown in FIGS. 3A through 3D. FIG. 3A shows the transfer function of transmission channel 201 which approaches zero asymptotically. FIG. 3B shows signal $e^{-\omega\tau}$. FIG. 3C represents the transfer function of pre-filter 207. FIG. 3D represents the total frequency response or the product of the signals represented in FIGS. 3A, 3B and 3C.

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[1] U.S. Patent No. 7,254,198, issued August 7, 2007 to Manickam et al., from an application filed April 28, 2000.
[2] U.S. Patent No. 6,996,380 B2, issued February 7, 2006 to Dent.
[3] U.S. Patent Application Publication No. US 2002/0176492 A1, published November 28, 2002, from an application filed May 11, 2001 by Zangi et al.
[4] Office Action of March 18, 2008, page 4, *citing* Manickam et al., *supra,* column 7, lines 6 through 20.

> The frequency response $H_c(f, l)$ of the complete channel does not include the effects of prefilter 207 . The analog prefilter 207 can be represented by $H_{PF}(s)=(b_1s+1)/(a_2s^2+a_1s+1)$, where $s=j\omega$. $H_{PF}(s)$, therefore, is characterized by the filter parameters b_1, a_1, and a_2. $H_{PF}(s)$ can be determined by minimizing a cost function that is related to the total intersymbol interference found in transmission system 200.[5]

Applicants first submit that this passage nowhere teaches the determining of a frequency response of a conditioned channel without reference to prefilters. While the reference states that the frequency response term $H_c(f,l)$ "does not include the effects of prefilter 207", the reference nowhere teaches the determining of this frequency response; rather, Applicants submit that this statement in the reference is merely defining the meaning of this term.

Applicants further submit that the remainder of the reference expressly discloses the opposite of the Examiner's assert. We begin with the passage cited by the Examiner, which teaches that the prefilter transfer characteristic $H_{PF}(s)$ is determined by minimizing a "cost function". The reference goes on to disclose just what the "cost function" is:

> In one embodiment, the transfer function $H_{PF}(s)$ of analog pre-filter **207** is obtained by minimizing the cost function
>
> $$C = \sum_{i=1}^{K} w_i E(l_i) + w_{K+1} P \qquad (10)$$
>
> with respect to the filter parameters b_1, a_1, and a_2 where w_i is a weight factor, l_i is the ith cable length, K is the number of cable lengths, and P is a high frequency penalty. The first K terms are a measure of Intersymbol Interference at cable lengths $l_1, l_2, \ldots l_K$.[6]

But the term *E(l)* expressly includes the prefilter transfer characteristic $H_{PF}(s)$ itself, according to the reference:

> A measure E(l) of the intersymbol interference due to the comparison of the folded spectrum with a flat spectrum can be expressed as

[5] Manickam et al., *supra,* column 7, lines 6 through 20.
[6] Manickam et al., *supra,* column 7, lines 48 through 59.

$$E(l) = \int_{-1/2T}^{1/2T} \left| \left[H_c(f,l) H_{PF}(s) e^{j\omega\tau} \right]_{fold} - 1 \right|^2 df \qquad (8)^7$$

As evident from this equation (8) of the reference, the measure *E(l)* expressly includes the prefilter transfer characteristic $H_{PF}(s)$ itself. This measure *E(l)*, including the prefilter transfer characteristic $H_{PF}(s)$ itself, is a term in the cost function of equation (10) that is being minimized to determine the characteristic of the desired prefilter according to the reference. Therefore, the Manickam et al. reference expressly, clearly, and unambiguously teaches that its prefilter transfer characteristic $H_{PF}(s)$ is obtained by minimizing a cost function that includes evaluation of the prefilter transfer characteristic $H_{PF}(s)$ itself.[8]

Indeed, the process of the Manickam et al. reference determines its prefilter transfer characteristic $H_{PF}(s)$ in the conventional manner described in the specification of Applicants' own application:

> The problem of designing (or training) a prefilter can be computationally complex, particularly if the prefilter is intended to combat both CCI and ISI. In one approach, the tap weights of the prefilter(s) *w* and the conditioned channel *b* are taken as variables that are to be optimized, constraints are imposed on the nature of *w* and *b*, and then *w* and *b* are jointly optimized relative to some merit function related to CCI and/or ISI.[9]

This is reflected in the Manickam et al. reference:

> The better determination of equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ is found by an iterative procedure as described below, resulting in determination of prefilter function $H_{PF}(s)$. *With an initial choice of equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ, the cost function C is minimized to determine an $H_{PF}(s)$*. Using this $H_{PF}(s)$, the equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ are determined for each cable length l_1 through l_K. *Using these new sets of equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ (one set of parameters for each cable length l_1 through l_K) in the cost function C, $H_{PF}(s)$ is recomputed. This process is repeated* until there are no significant changes between successive iterations. In other words, the above

7 Manickam et al., *supra,* column 7, lines 21 through 27.
8 Manickam et al., *supra,* column 7, lines 14 through 59.
9 Specification of S.N. 10/816,781, paragraph [0010].

> procedure converges to a particular set of filter parameters for $H_{PF}(s)$ that determines prefilter 207.[10]

As evident in this passage of the Manickam et al. reference, its method "jointly optimizes" the equalizer parameters $H_{EQ}(z)$ (the equalizer 212 removing the remainder of the interference[11] not removed by the prefilter) and the prefilter function $H_{PF}(s)$. Clearly, therefore, the Manickam et al. reference teaches the training of prefilters *with* reference to the prefilters themselves, and therefore does not and cannot disclose the determining step of claim 1.

For this reason, Applicants respectfully submit that the §102 rejection of claims 1, 3, 10, and 11 is in error, as based on a misinterpretation of the Manickam et al. reference. Applicants submit that these claims are in fact novel over that reference, because the reference fails to disclose the determining step of claim 1.

As mentioned above, claims 2, 4 through 9, and 12 through 19, all dependent on claim 1, were rejected under §103 as unpatentable over the Manickam et al. reference in view of the Dent reference. The Manickam et al. reference was applied as discussed above relative to claim 1, and the Dent reference was applied for its teachings regarding the limitations of the dependent claims.

Applicants traverse the §103 rejection on similar grounds as discussed above relative to claim 1, more specifically on the grounds that the combined teachings of the references fall short of the requirements of these dependent claims. As discussed above, Applicants submit that the Manickam et al. reference fails to disclose the determining of the frequency response of a conditioned channel without reference to the branch-specific prefilters, but instead teaches the use of the prefilter characteristics itself in an iterative optimization process. The Dent reference also lacks disclosure of this step of claim 1. As previously urged, claim 1 and its dependent claims are directed to a method of training prefilters in a receiver, while the cited teachings of the Dent reference are to filters 30 in a numerical processor 20 that is part of a *transmit processor*. Nowhere does the Dent reference disclose, in a method of training prefilters in a receiver, the

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[10] Manickam et al., *supra,* column 8, lines 46 through 60 (emphasis added).
[11] Manickam et al., *supra,* column 5, lines 60 through 63.

determining of the frequency response of a conditioned channel without reference to the branch-specific prefilters, as required by claim 1 and all of its dependent claims.

Nor is there any suggestion from the prior art or indication that the skilled artisan, using his or her ordinary creativity, would modify these teachings in such a manner as to arrive at the invention of claim 1 and its dependent claims. This is especially evident from the correspondence between the Manickam et al. teachings and the conventional method of training prefilters described in the specification – accordingly, the Manickam et al. approach to this function necessarily includes the limitations that the invention of claim 1 is intended to overcome. The teachings of the Dent reference, as previously argued, lack applicability to this problem, and would not assist the skilled person in arriving at the claimed solution.

Accordingly, Applicants submit that claim 1 and its dependent claims are all patentably distinct over the combination of the Manickam et al. and Dent references, and indeed over all of the prior art of record in this case.

Claims 20, 22, 29, and 36 were rejected under §102(e) as anticipated by the Manickam et al. reference. Claims 21, 23 through 28, 31 through 35, 37, and 38 were rejected under §103 as unpatentable over the Manickam et al. reference in view of the Dent reference. Claim 39 was rejected under §103 as unpatentable over the Manickam et al. reference and the Dent reference, and further in view of the Zangi et al. reference.

Applicants respectfully traverse the rejection of these claims, on similar grounds as discussed above relative to claim 1.

Claim 20 is directed to a receiver that receives at least two branch-specific signals. The claimed receiver includes a training module that includes a first module for determining a frequency response of a conditioned channel without reference to branch-specific prefilters, in combination with a second module for computing frequency responses of branch-specific prefilters (applied in prefilter modules) from that determined frequency response. The amendment to claim 20 is presented merely to clarify the claim and to avoid a possible indefiniteness; Applicants submit that this amendment to claim 20 is in no way narrowing nor is

presented for any reason related to patentability, given the absence of any §112 rejection raised by the Examiner.[12]

As discussed above with respect to claim 1, Applicants submit that the Examiner errs in the assertion that the determining of a frequency response of a conditioned channel without reference to branch-specific prefilters is taught by the Manickam et al. reference. Not only does the reference fail to disclose a first module for determining of a frequency response of a conditioned channel without reference to prefilters, but the reference in fact teaches the use of the prefilter transfer characteristic $H_{PF}(s)$ in an iterative determination of that very characteristic. Specifically, the Manickam et al. reference teaches that the transfer function of its prefilter is determined by minimizing a "cost function":

> In one embodiment, the transfer function $H_{PF}(s)$ of analog pre-filter **207** is obtained by minimizing the cost function
>
> $$C = \sum_{i=1}^{K} w_i E(l_i) + w_{K+1} P \qquad (10)$$
>
> with respect to the filter parameters b_1, a_1, and a_2 where w_i is a weight factor, l_i is the ith cable length, K is the number of cable lengths, and P is a high frequency penalty. The first K terms are a measure of Intersymbol Interference at cable lengths $l_1, l_2, \ldots l_K$.[13]

But the term *E(l)* expressly includes the prefilter transfer characteristic $H_{PF}(s)$ itself:

> A measure E(l) of the intersymbol interference due to the comparison of the folded spectrum with a flat spectrum can be expressed as
>
> $$E(l) = \int_{-1/2T}^{1/2T} \left| \left[H_c(f,l) H_{PF}(s) e^{j\omega\tau} \right]_{fold} - 1 \right|^2 df \qquad (8)$$[14]

Accordingly, the Manickam et al. reference determines its prefilter transfer function by an iterative process:

> The better determination of equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ is found by an iterative procedure as described below, resulting in

[12] *See Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.,* 535 U.S. 722, 62 USPQ2d 1705 (2002), *on remand,* 304 F.3d 1289, 64 USPQ2d 1698 (Fed. Cir. 2002).
[13] Manickam et al., *supra,* column 7, lines 48 through 59.
[14] Manickam et al., *supra,* column 7, lines 21 through 27.

> determination of prefilter function $H_{PF}(s)$. *With an initial choice of equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ, the cost function C is minimized to determine an $H_{PF}(s)$.* Using this $H_{PF}(s)$, the equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ are determined for each cable length l_1 through l_K . *Using these new sets of equalizer parameters for $H_{EQ}(z)$, gain g, and timing phase τ (one set of parameters for each cable length l_1 through l_K) in the cost function C, $H_{PF}(s)$ is recomputed. This process is repeated* until there are no significant changes between successive iterations. In other words, the above procedure converges to a particular set of filter parameters for $H_{PF}(s)$ that determines prefilter 207.[15]

Therefore, the Manickam et al. reference expressly states that its prefilter transfer characteristic $H_{PF}(s)$ is obtained by minimizing a cost function that includes evaluation of the prefilter transfer characteristic $H_{PF}(s)$ itself.[16] The reference therefore necessarily fails to disclose the first module of the training module in the receiver of claim 20, because it fails to disclose any structure that determines a frequency response of a conditioned channel that suppresses the interference, wherein the frequency response is determined without reference to branch-specific prefilters.

Applicants further respectfully traverse the §103 rejection of the claims dependent on claim 20. As discussed above, Applicants submit that claim 20 is novel because the Manickam et al. reference fails to disclose a first module for determining the frequency response of a conditioned channel without reference to the branch-specific prefilters, but instead teaches the use of the prefilter characteristics itself in an iterative optimization process. Applicants further submit that neither the Dent reference nor the Zangi et al. reference teaches this module. Rather the teachings of the Dent reference are directed to filters in a numerical processor of a transmit processor, and neither it nor the Zangi et al. reference discloses the determining and computing functions performed by the modules of claim 20. Accordingly, the combined teachings of the applied references necessarily fall short of the requirements of claim 20 and its dependent claims.

Furthermore, because the Manickam et al. reference appears to disclose a receiver corresponds to the conventional method described in the specification, in regard to the training of a prefilter, Applicants submit that the Manickam et al. receiver suffers from the very limitations

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[15] Manickam et al., *supra,* column 8, lines 46 through 60 (emphasis added).
[16] Manickam et al., *supra,* column 7, lines 14 through 59.

that the receiver of claim 20 overcomes by virtue of the claimed invention. Neither the Manickam et al. reference nor the other references of record disclose or suggest the training module of claim 20, nor would these references nor anything else in the prior art stir the ordinary creativity of the person of ordinary skill in the art so as to reach claim 20 and its dependent claims.

For these reasons, Applicants submit that claim 20 and its dependent claims are not only novel, but are patentably distinct, over the references of record in this case.

Applicants respectfully submit that all claims now in this case are in condition for allowance. Reconsideration of this application is therefore respectfully requested.

Respectfully submitted,
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